M16C Family PC7501 Emulator

Graphical Display of Data Trace Results

Overview

The full-spec emulator PC7501 for the M16C family provides a data trace function that analyzes realtime trace measurement results and graphically displays data access information. This document describes how to graphically display data access information from data trace results by using the PC7501 emulator.

In the description, a user system with an M16C/60 series microcomputer is connected with the PC7501 emulator. The contents of this document are applicable to cases there a user system with any microcomputer is used with the PC7501 emulator. Graphical display of data trace results is also available for the M16C and M32C simulator.

Contents

1. Specifications

The data trace function in the PC7501 emulator analyzes the results of the realtime trace measurement function, which records the history of target program execution (up to 256-K cycles of execution) through the data trace window, and graphically displays data access information. Through this function, the memory status in the specified cycle or the change of data at the specified memory address can be monitored. This function can be used in connection with the [Trace] window.

2. Functional Descriptions

This document explains how to graphically display the data trace results by using the sample program provided in the PC7501 emulator CD-ROM or in the package that can be downloaded from the Renesas website.

The versions of each tool are as follows:

PC7501 emulator software:

    -M16C PC7501 Debugger V1.03 Release 00

M16C/60, 30, Tiny, 20, 10, R8C/Tiny series C compiler package:

    -M3T-NC30WA V.5.43 Release 00

3. Software Preparation

3.1 Introduction

Install the software provided in the CD-ROM of the PC7501 emulator to expand the sample program (tutorial workspace) to be used with this document on your personal computer.

3.2 Installing the PC7501 Emulator Software

Execute M16cPc7501Debugger.exe from the CD-ROM of the PC7501 emulator. For details on installation, refer to the setup guide for the PC7501 emulator on the Renesas website and follow the directions shown on the screen during installation. The full installation procedure is not described in this document.

3.3 Installing Other Necessary Software

(1) In the description in this document, part of the sample program is modified before the program operation is checked. For this purpose, the M16C/60, 30, Tiny, 20, 10, R8C/Tiny series C compiler package is necessary. Install a production-version compiler package if you have one.

(2) If you do not have a production-version compiler package, a free evaluation-version compiler package is available from the CD-ROM of the E8 emulator or from the Renesas website. The free evaluation-version M16C/60, 30, Tiny, 20, 10, R8C/Tiny series C compiler package can be found from the top page by selecting [Support], [Download], [Download Search], and [Select Category], in that order, then selecting [Evaluation Version]. Links to the Renesas website are given in the last section of this document. Notes on restrictions and instructions for installing the evaluation version are available on the download page.

(3) When the auto-update utility is selected upon installation of software, the latest versions of the tools can be found through internet.

4. Operations

This section explains how to activate the High-performance Embedded Workshop (HEW) and how to display data trace results graphically in the following steps.
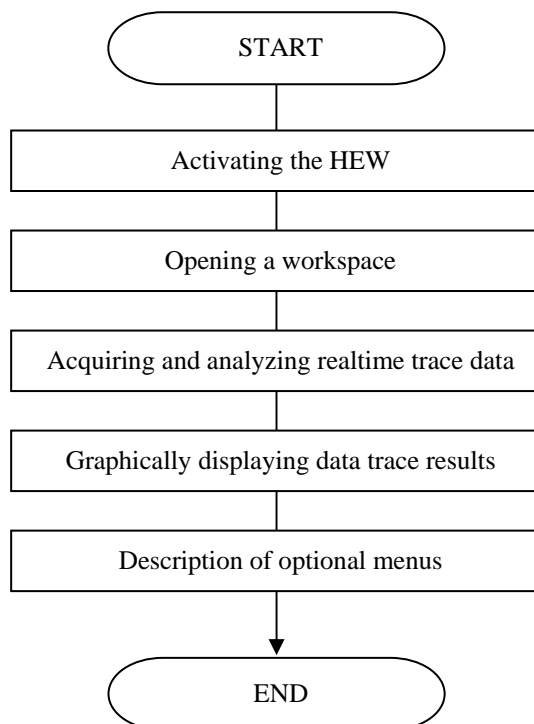
```
                    ┌─────────────────────┐
                    │       START         │
                    └─────────────────────┘
                               │
                    ┌─────────────────────┐
                    │  Activating the HEW │
                    └─────────────────────┘
                               │
                    ┌─────────────────────┐
                    │ Opening a workspace │
                    └─────────────────────┘
                               │
          ┌──────────────────────────────────────────┐
          │ Acquiring and analyzing realtime trace data│
          └──────────────────────────────────────────┘
                               │
          ┌──────────────────────────────────────────┐
          │  Graphically displaying data trace results │
          └──────────────────────────────────────────┘
                               │
          ┌──────────────────────────────────────────┐
          │      Description of optional menus         │
          └──────────────────────────────────────────┘
                               │
                               ▼
                    ┌─────────────────────┐
                    │        END          │
                    └─────────────────────┘
```

Figure 4.1   Procedures for Sample Program Execution

## 4.1   Activating the High-Performance Embedded Workshop

First, connect the PC7501 emulator with the user system to the host computer via the USB cable, and check that debugging is enabled.

Next, activate the High-performance Embedded Workshop by opening the [Start] menu and selecting [All Programs], [Renesas], [High-performance Embedded Workshop], and [High-performance Embedded Workshop], in that order.
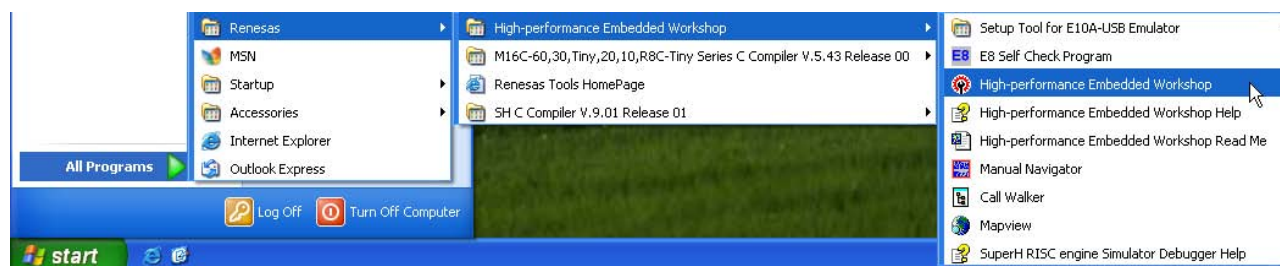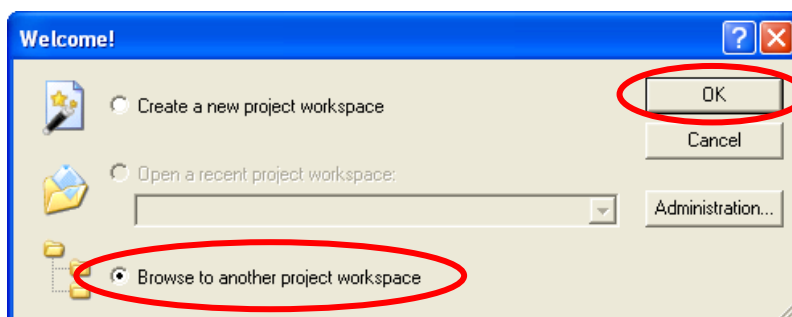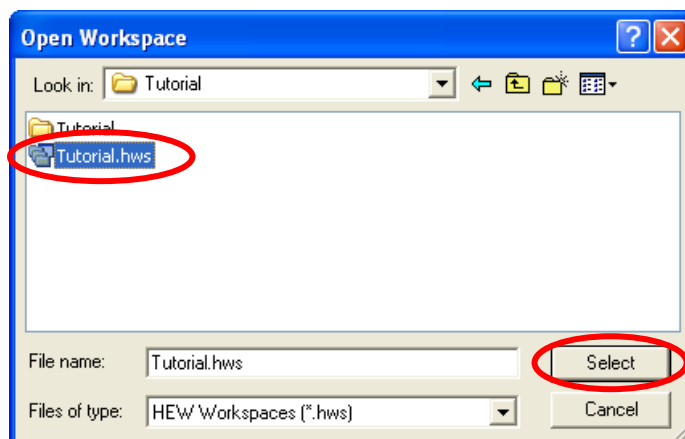
4.2　　Opening a Workspace

（1）The [Welcome!] dialog box will appear on the High-performance Embedded Workshop screen.
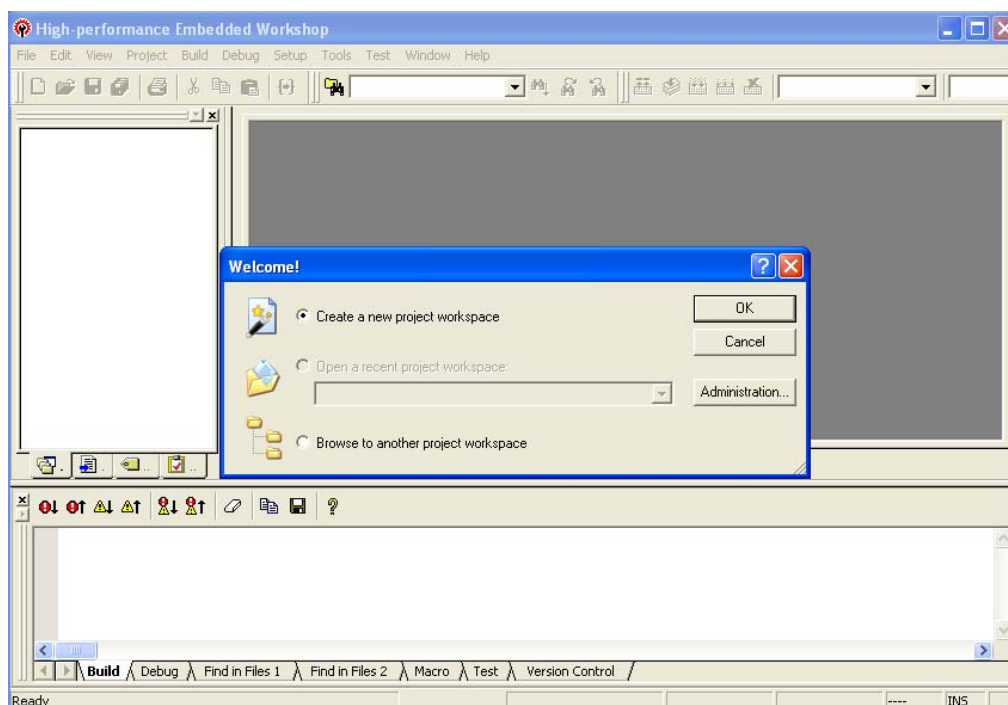
Select the [Browse to another project workspace] radio button in the [Welcome!] dialog box and click on the [OK] button.

⑵　The [Open Workspace] dialog box will appear.

When the software from the CD-ROM of this product has been installed, workspace "Tutorial.hws" is stored in the folder structure shown below (standard location). Specify the correct location by opening the folders in order. Select the workspace "Tutorial.hws" and click on the [Select] button.

C:¥WorkSpace¥Tutorial¥PC7501¥M16C¥Tutorial¥Tutorial.hws
C:¥WorkSpace 　　└Tutorial 　　　　└PC7501 　　　　　　└M16C 　　　　　　　　└Tutorial 　　　　　　　　　　└Tutorial.hws

Note:　The above directory may not be specifiable depending on the software version. In this case, select the following directory.

<High-performance Embedded Workshop installation directory>

¥Tools¥Renesas¥DebugComp¥Platform¥E8¥M16C¥Tutorial

Directory examples:

C:¥hew3¥Tools¥Renesas¥DebugComp¥Platform¥E8¥M16C¥Tutorial

C:¥hew2¥Tools¥Renesas¥DebugComp¥Platform¥E8¥M16C¥Tutorial

⑶　If the workspace version is old, the following dialog box will appear. To update it to the new version, click on the [OK] button.
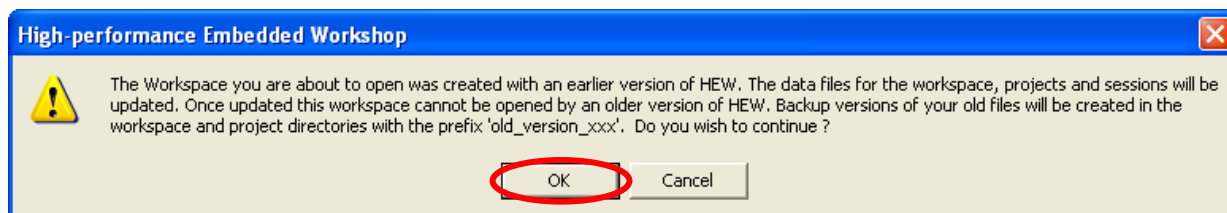
(4) After the workspace has opened, operation on the High-performance Embedded Workshop screen becomes available. Switch the session to connect the PC7501 emulator; switch from [DefaultSession] to [SessionM16C_R8C_PC7501_Emulator] on the toolbar.

Firstly, turn the interface switch on the rear panel of the PC7501 emulator main unit to the USB side, and then turn on the power.
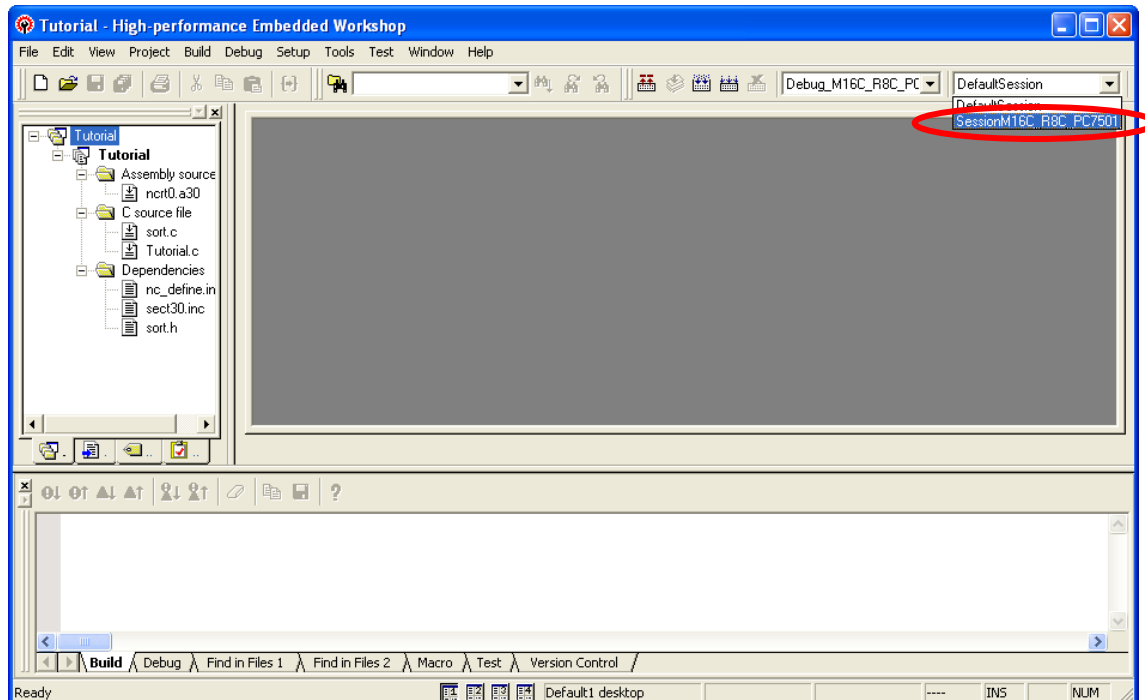
If a dialog box appears asking whether to save the previous session, select [Yes].
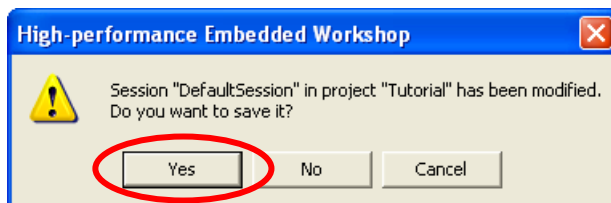
（5） The [Init (M16C R8C PC7501 Emulator)] dialog box will appear. In the [MCU] tab, specify the MCU file corresponding to the emulation probe in use by clicking on the [Refer…] button, select the [USB] radio button, and click on [OK].
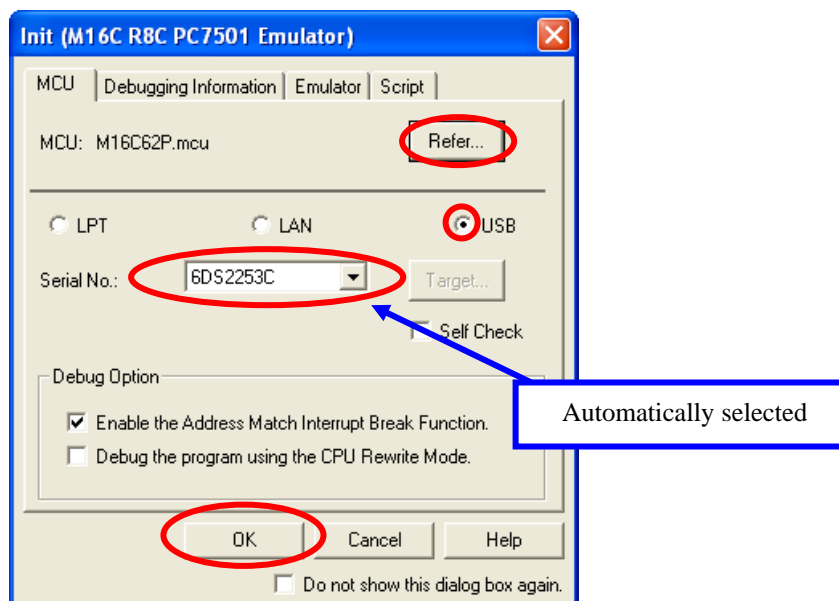
- When connecting the emulator through LPT or LAN instead of USB, refer to the PC7501 user's manual on the Renesas website.

（6） The [MCU Setting] dialog box will appear. Select "Single-Chip Mode" for [Processor Mode] in the [MCU] tab, and click on [OK].
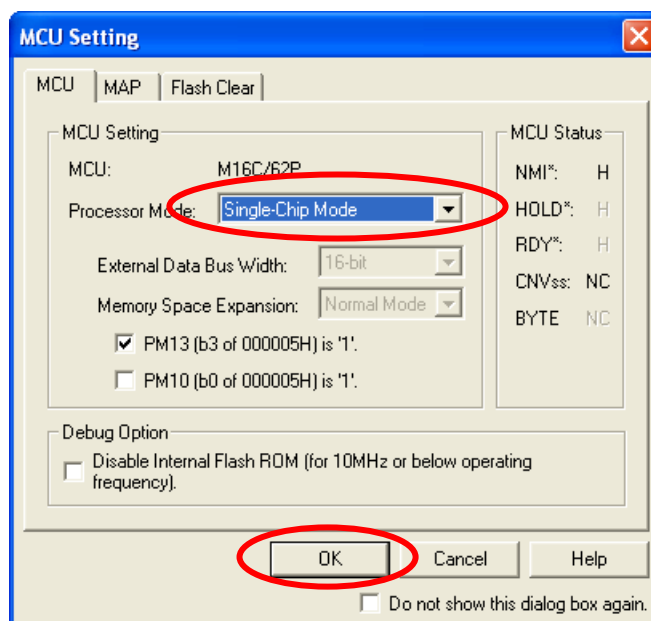
（7） After the PC7501 emulator has been successfully connected, operation on the High-performance Embedded Workshop screen becomes available. When the connection has been completed, "Connected" is displayed in the [Debug] tab of the [Output] window.
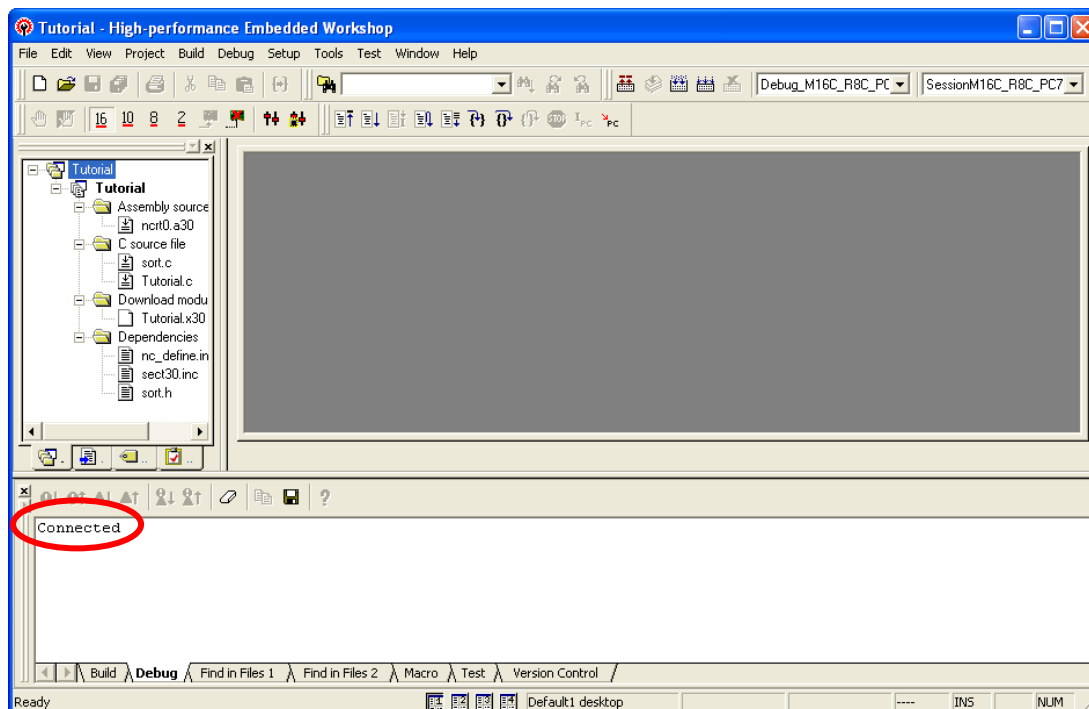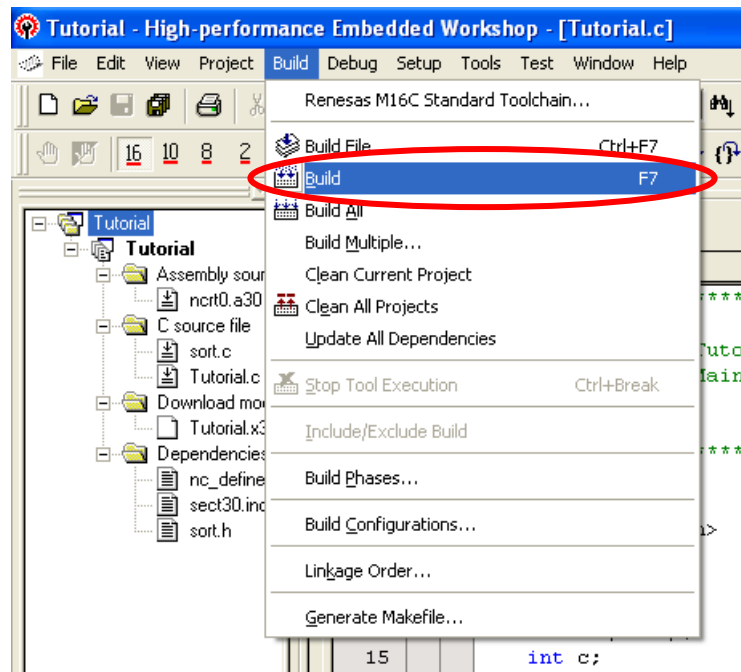

4.3 Acquiring and Analyzing Realtime Trace Data

First, execute the target program, and acquire and analyze realtime trace data.

（1） Add the codes shown in the red boxes in the following figure to source file "Tutorial.c".
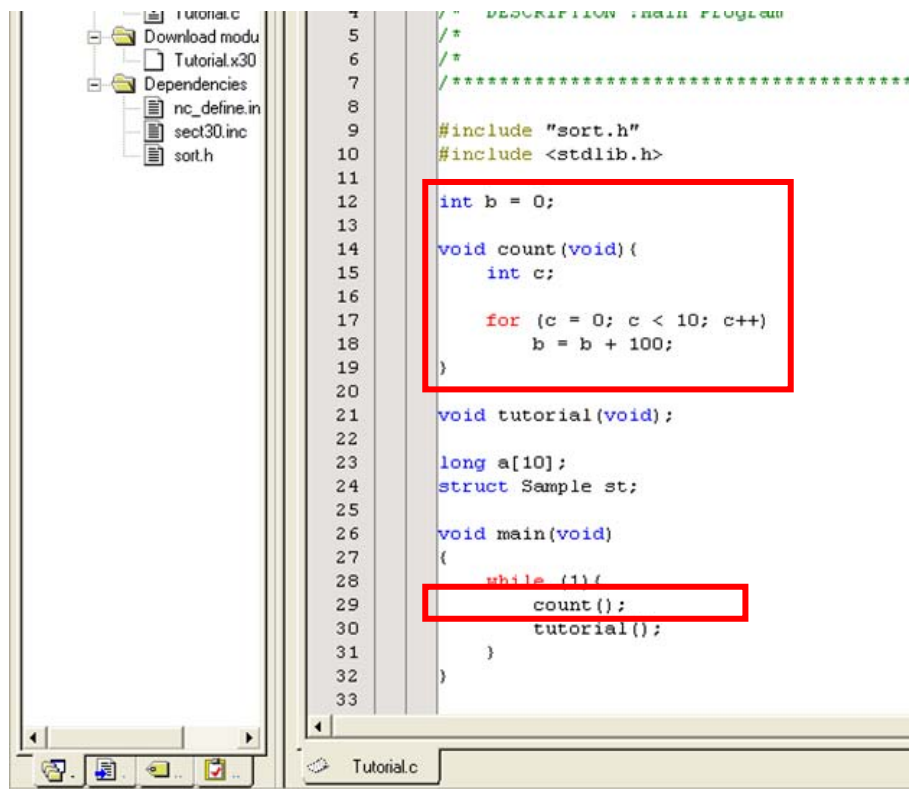
（2） Build a project to reflect the modifications made in source file Tutorial.c. Click on [Build] in the [Build] menu.


When there is no error in the codes added to source file "Tutorial.c", the message (0 Errors, 0 Warnings) shown in the following figure will be displayed in the [Output] window.
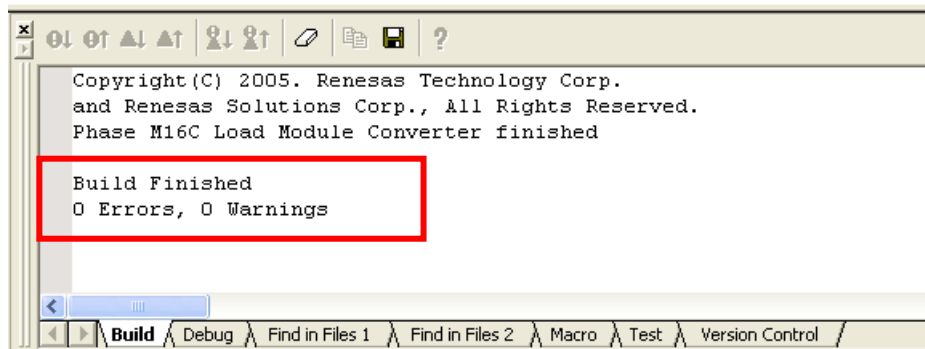
（3） When the build process has been completed, the [Confirmation Request] dialog box will appear. Select "No to all".
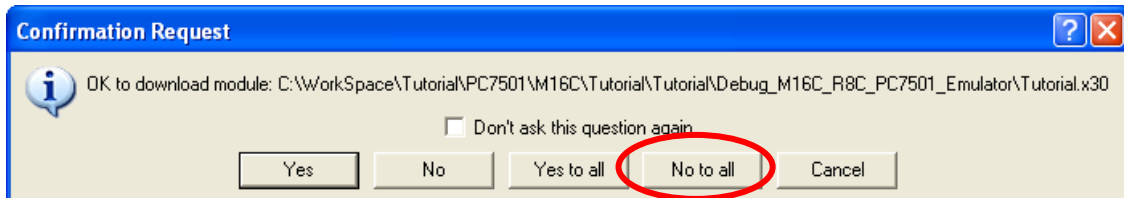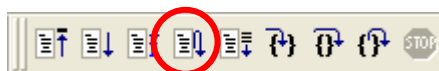
（4） Next, download the target program; double-click on [Tutorial.x30 - 00000000] under [Download modules] on [Workspace].
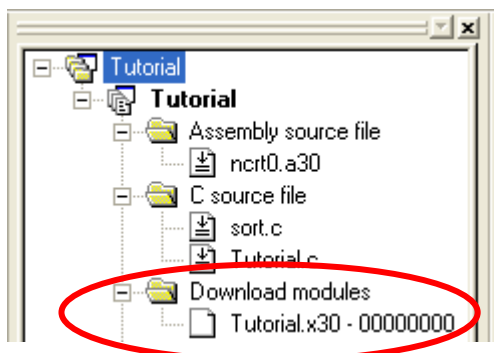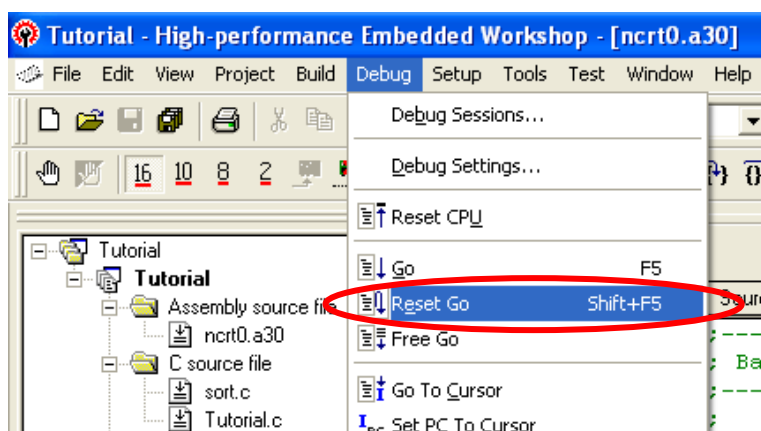

When the program has been downloaded, a downward arrow will appear on the icon of the file.
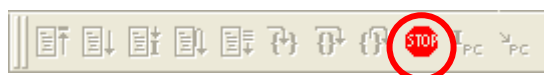

（5） Click on the [Reset Go] icon to execute the program.


[Reset Go] can also be selected from the [Debug] menu.

（6） After execution of the target program for an appropriate period, click on the [STOP] icon at any desired point of time to stop program execution (execution can also be stopped from the [Debug] menu).

（7） Next, open the data trace window; open the [View] menu and select [Trace] and [Data Trace] in that order.
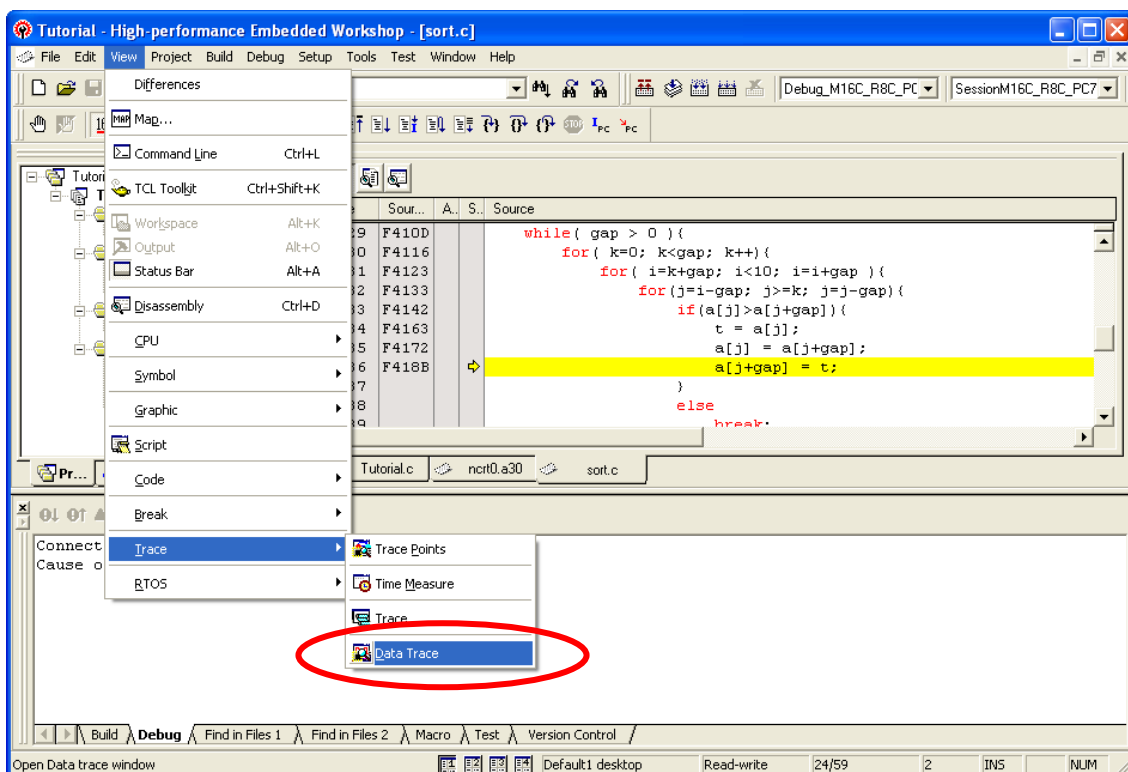
（8） The data trace window will open. To display data in the data trace window, analyze the trace data; right-click on the data trace window and select [Analyze Trace Data].
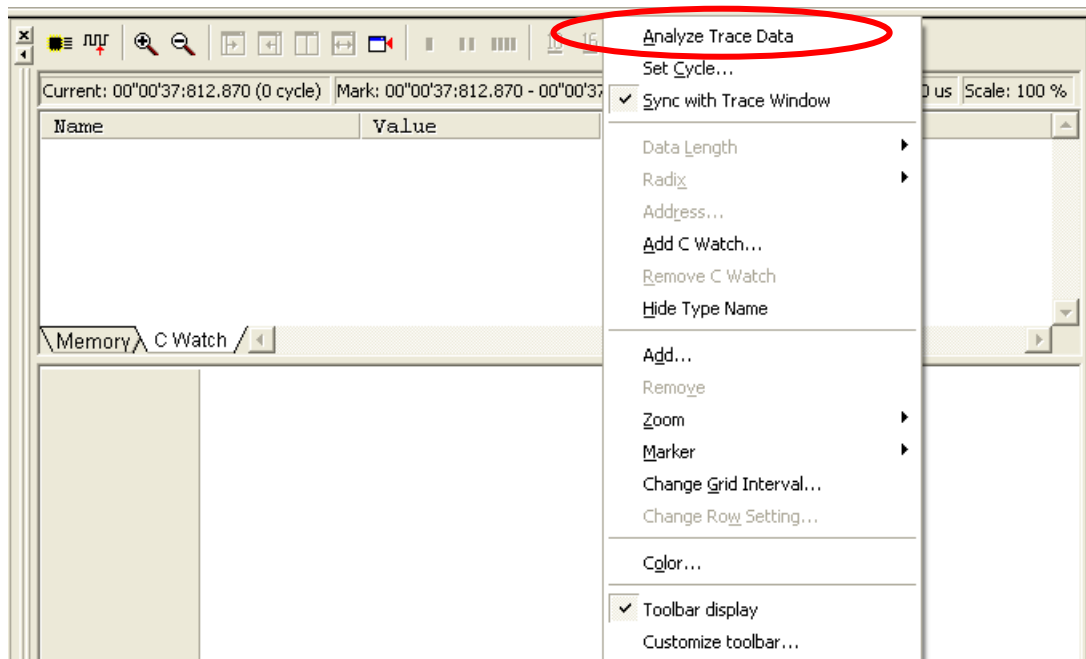
This operation can also be selected through the [Analyze] icon in the top left corner of the data trace window.

⑼ When analysis starts, the [Analyze trace data] dialog box will appear. Wait for a while. To abort analysis, click on [Cancel]. If an analysis in progress is cancelled, the data trace window will show data for the range analyzed up to that point.
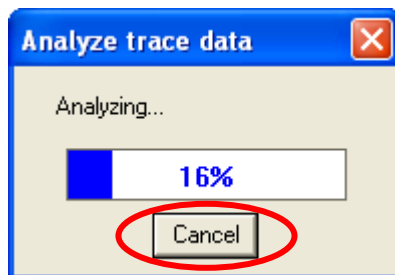
## 4.4 Graphically Displaying Data Trace Results

Next, specify target variables to monitor through the data trace window and to graphically display the access history.

⑴ No symbols are registered by default; specify target variables to monitor. Right-click on the [C Watch] tab of the data trace window and select [Add C Watch].
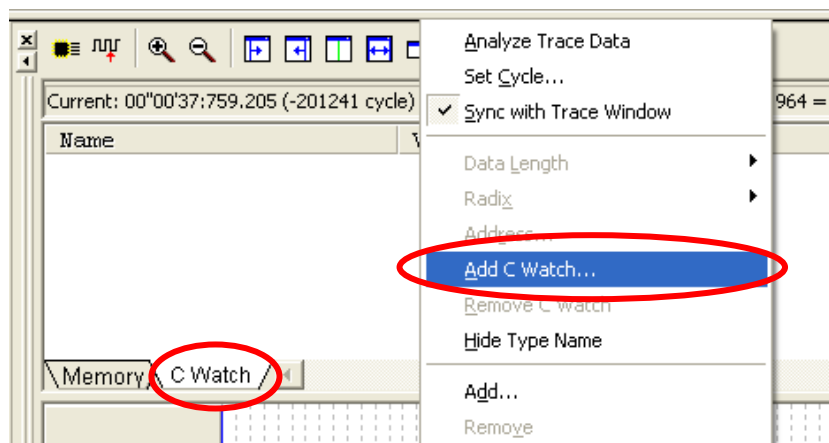
- Variables can also be specified by dragging and dropping from other windows (the editor window or C watch window).

- If a local variable is specified, a correct value cannot be displayed. When specifying a file local variable, be sure to specify it while the variable is within the scope.

⑵ The [Add] dialog box will appear. Enter a target variable and click on [OK]. In this example, enter two variables, "a[0]" and "b".
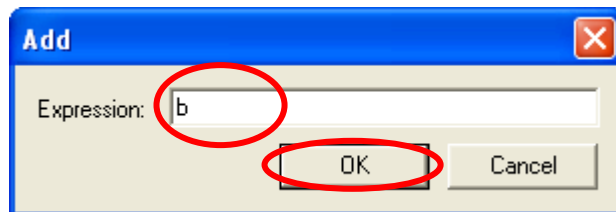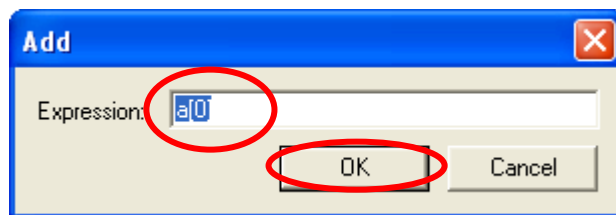
⑶ The specified variables will be displayed in the data reference area of the data trace window. The values shown under [Value] are C-variable values in the specified cycle (the point at the indicator).
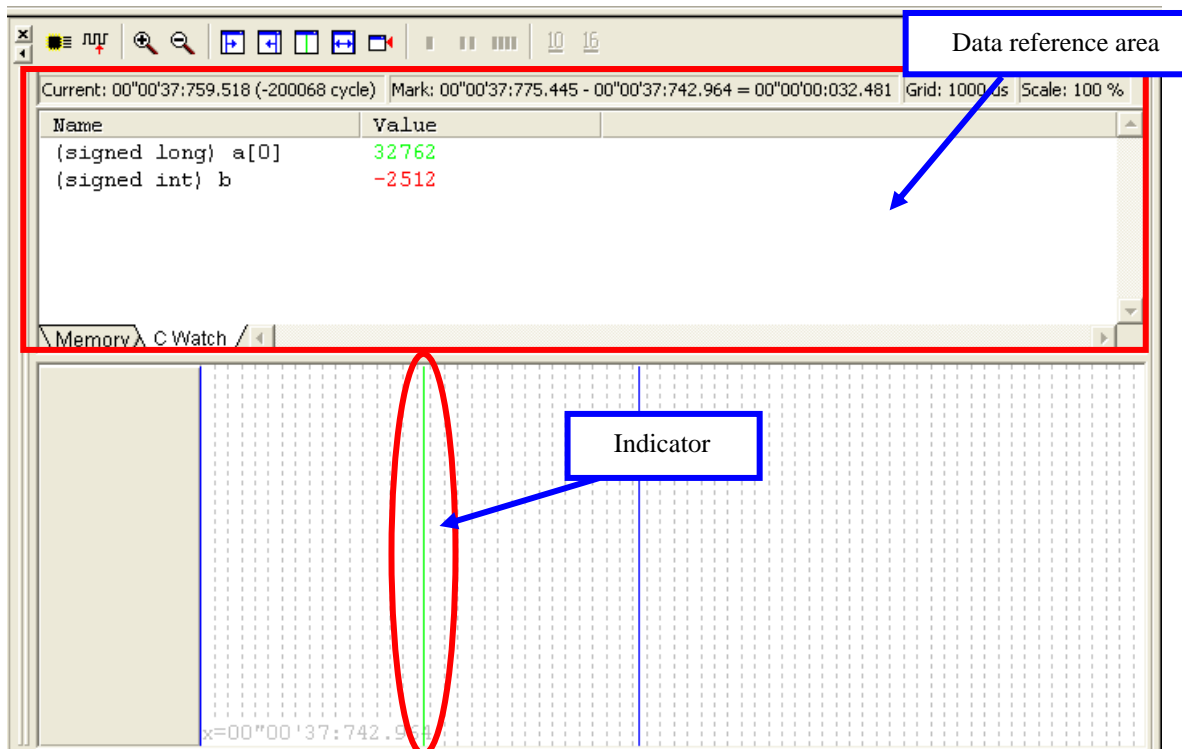
（4） To delete a specified variable, select the target variable, right-click on it, and select [Remove C Watch].
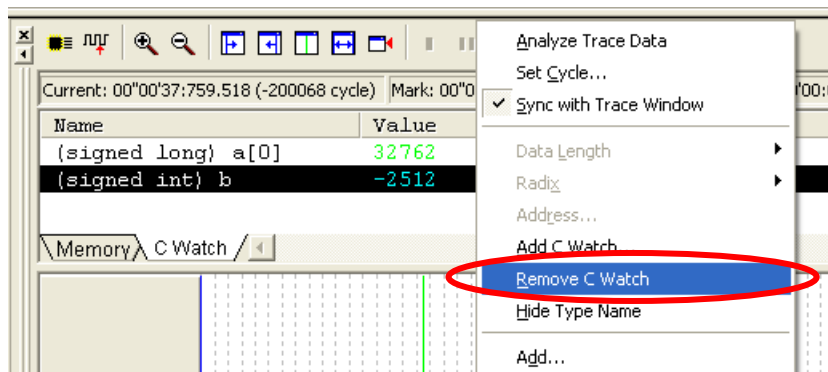
（5） Then, display the history of access to the specified variables graphically; right-click on the [C Watch] tab of the data trace window and select [Add...] or click on the [Add] icon.
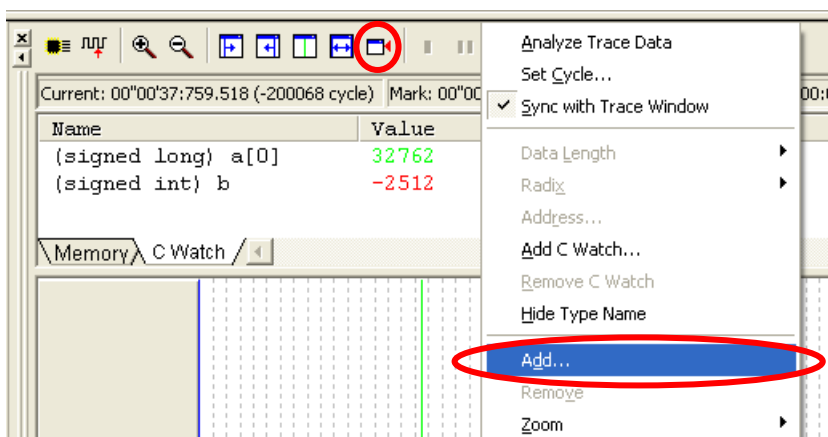
Watch items can also be added by dragging and dropping from other windows (the editor window or C watch window).

（6） After the items have been added, the access history reference area will display the history of access to the variables graphically.

- On each row, the maximum and minimum values of the specified variable are shown at the left end, and the y value of the horizontal grid is shown at the right end. The x value (time) of the left end of the current graph is shown in the bottom left corner.
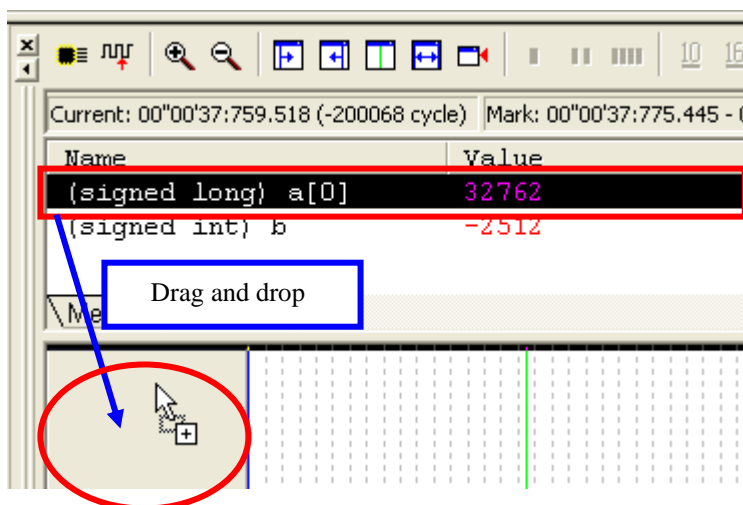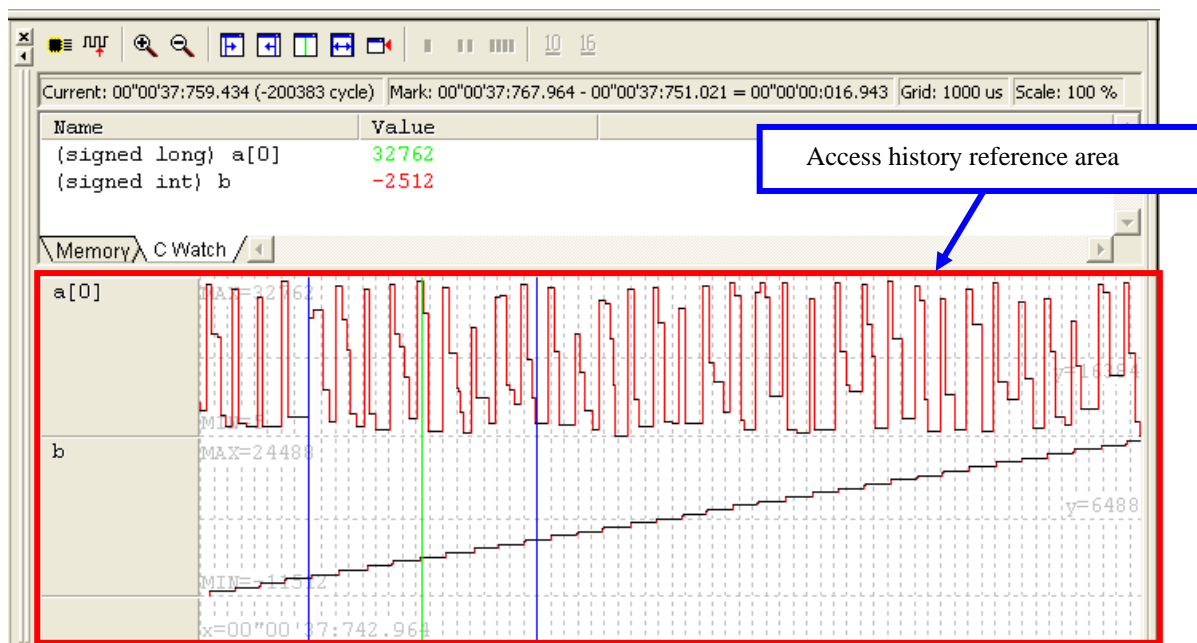
- The parameters shown at the top of the data trace window indicate, from left to right, the time of the point at the indicator (Current), the time of the point at the marker (Mark), the grid interval (Grid), and the display scale (Scale). The green line is the indicator and the blue one is the marker.

- In the access history reference area, you can see the history of access to specified addresses in a chart.

- The indicator location can be linked with the [Trace] window, and you can check the memory values in the cycle that you are inspecting in the [Trace] window. In addition, the cycle at the indicator can also be displayed in the [Trace] window.

（7） To delete a specified variable, select the target variable, right-click on it, and select [Remove].
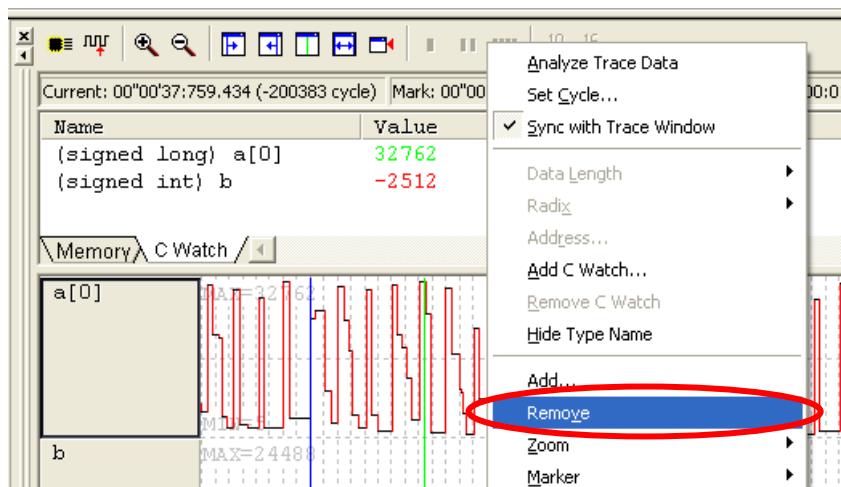
4.5　Optional Menus

This section describes the optional menus displayed by right-clicking on the data trace window.
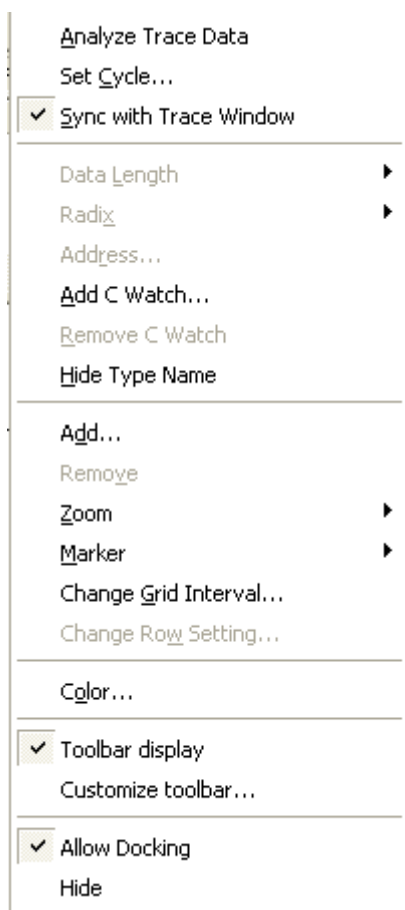
(1) Analyze Trace Data (see (8) in section 4.3)

Analyzes the realtime trace data and acquires data access information. If data analysis in progress is canceled, the data trace window shows information for the cycles analyzed up to the cancellation point.
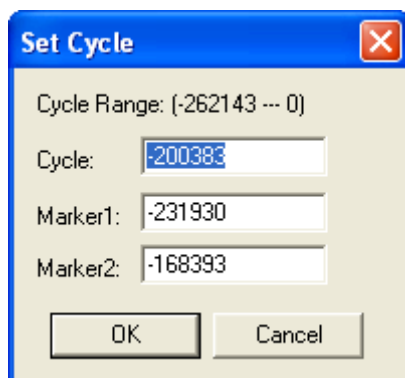
(2) Set Cycle...

Changes the indicator and marker locations.

[Set Cycle...] can also be specified through an icon.

(3) Sync with Trace Window

Selects whether to synchronize the operation with the [Trace] window. When this menu is selected (a check mark is displayed), the indicator in the data trace window moves in synchronization with the cycle displayed in the [Trace] window.

(4) Add C Watch… (see (1) in section 4.4)

Adds a variable in the data reference area. As this menu operation is applied to the current active display area, be sure to click on the display area where data items should be registered before selecting this menu.

(5) Remove C Watch (see (4) in section 4.4)

Removes the selected variable from the data reference area. This menu operation is applied to the current active display area.

(6) Hide Type Name

Selects whether to display the variable types when the data reference area is displayed in C-variable form. The following figure is a sample display when this menu is selected (a check mark is displayed).

（7）Add... (see (5) in section 4.4)
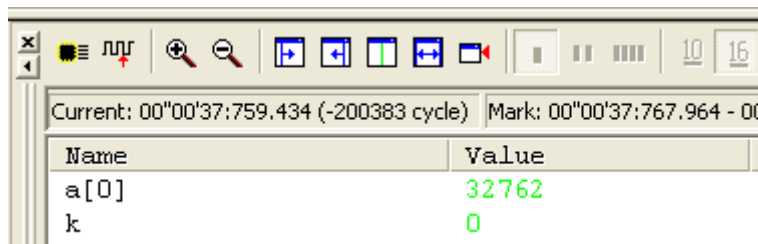
Adds an address or variable in the access history reference area. As this menu operation is applied to the current active display area, be sure to click on the display area where data items should be registered before selecting this menu.

（8）Remove (see (7) in section 4.4)

Removes the selected address or variable from the access history reference area. This menu operation is applied to the current active display area.

（9）Zoom

Changes the scale of display in the access history reference area. [Zoom In] increases the scale by 20%, and [Zoom Out] reduces it by 20%. In addition, any desired scale can be specified through [Set Scale].
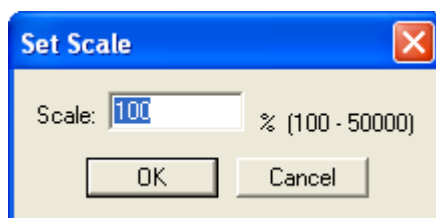
The [Zoom In] and [Zoom Out] operations can also be selected through icons.
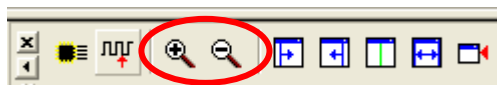
（10）Marker

Moves the marker and indicator to the current display in the access history reference area. Selecting [Adjust] magnifies the display of the range between the two markers to the full width of the window.

The [Marker] operations can also be selected through icons.
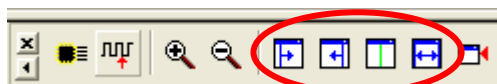
（11）Change Grid Interval...

Specifies the grid interval in the access history reference area.
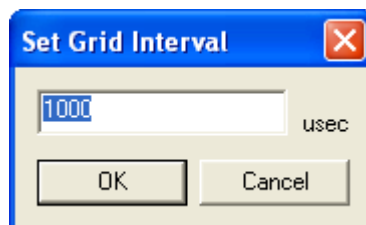
（12） Change Row Setting...

Changes the settings for each row in the access history reference area.
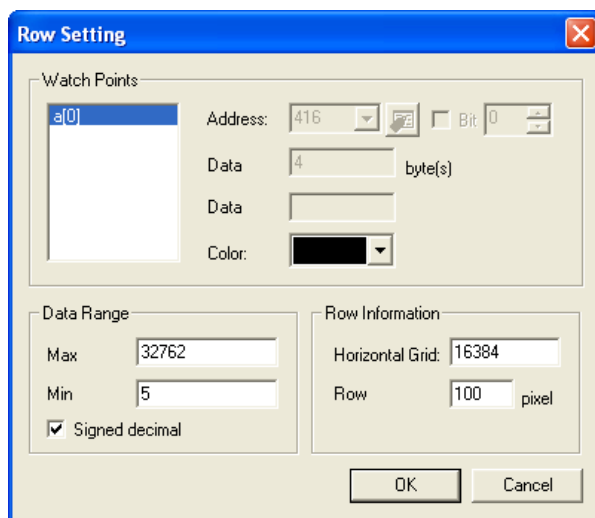
The following settings can be made.

- Masking registered data

- Changing the display color for each registered data item

- Changing the display data range

- Changing the height of the row.

（13） Color...

Changes the color of the display in the window. The background color for each display area and the color for characters can be changed.
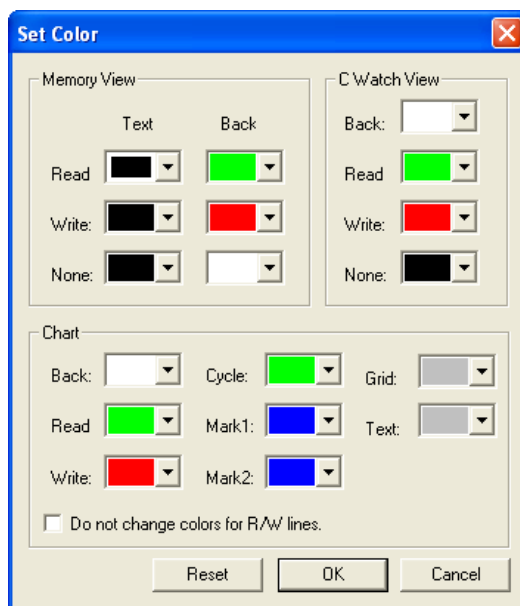
When "Do not change colors for R/W lines" is selected, the color for the y axis is the same as that for the x axis in the access history display (by default, the y axis color is green for read access or red for write access).

Clicking on the [Reset] button resets the display colors to the default settings.

This is the end of the explanation on graphically displaying the data trace results.

5.   Frequently Asked Questions

5.1   How can I compare changes in multiple data items?

Drag and drop the multiple data items into the same row of the access history reference area, and you can see the overlapped access histories in one row.
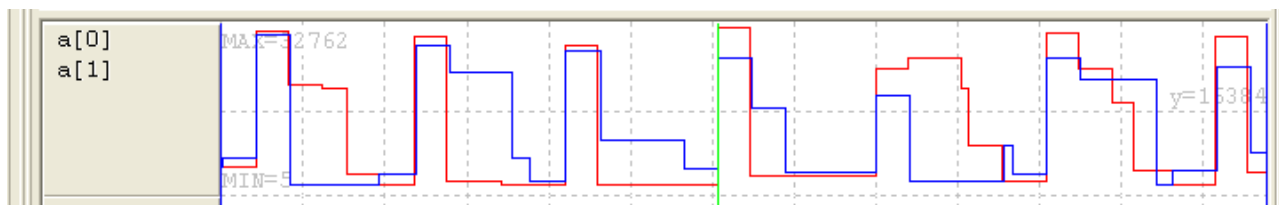
In this case, you can easily compare the data items by selecting "Do not change colors for R/W lines" in the [Color...] menu and specifying different colors for the multiple data items in the [Change Row Setting...] menu.

5.2   How can I check the variable access history when the range between the maximum and minimum values is wide?

When the displayed range of changes of the value is small with respect to the range between the maximum and minimum values of the variable, you may not see the changes in the display in the window. In this case, change the maximum and minimum values for display of the data in the [Change Row Setting...] menu.
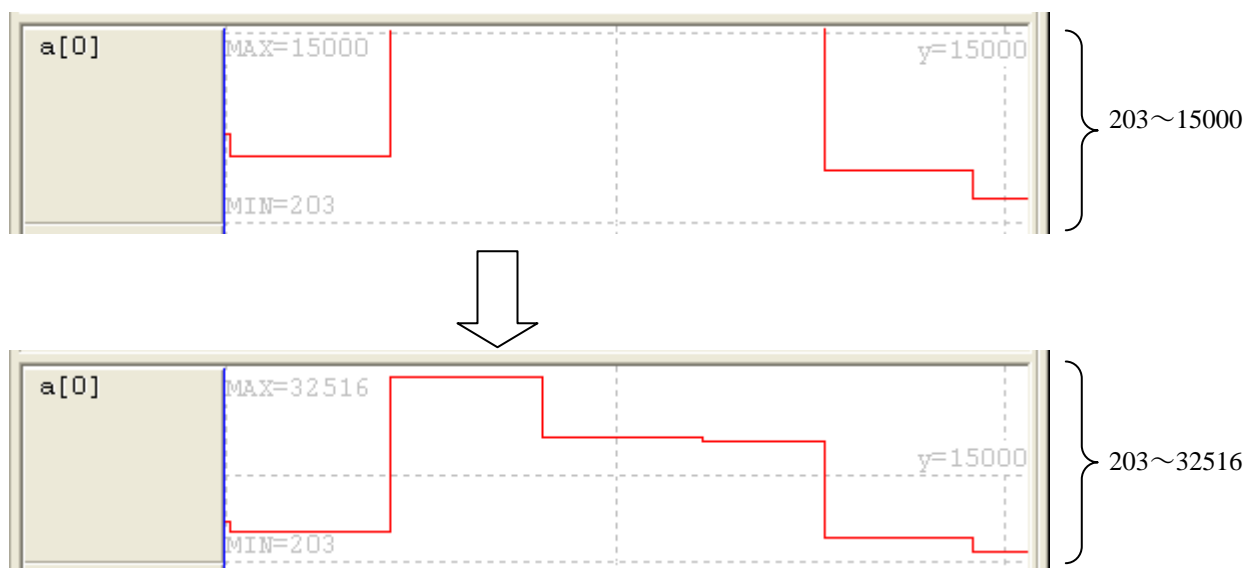
6. Related Documents

The PC7501 emulator and High-performance Embedded Workshop provide many other useful functions not mentioned in this document. Please refer to the following related documents for important information such as detailed specifications, technical information, or restrictions on each product.

[Documents Related to the PC7501 Emulator]

- ・ M16C R8C PC7501 Emulator Debugger User's Manual (for M16C/60, M16C/30, M16C/Tiny, R8C/Tiny Series)
- ・ M16C R8C PC7501 Emulator Debugger Release Notes (for M16C/60, M16C/30, M16C/Tiny, R8C/Tiny Series)
- ・ PC7501 Setup Guide (Emulator for M16C Family)
- ・ PC7501 User's Manual (Emulator for M16C Family)

[Documents Related to High-Performance Embedded Workshop]

- ・ High-performance Embedded Workshop User's Manual
- ・ High-performance Embedded Workshop Release Note

[Documents Related to MCU]

- ・ M16C/62P Group(M16C/62P,M16C/62PT) Hardware Manual
- ・ M16C/60, M16C/20, M16C/Tiny Series Software Manual

[Documents Related to M16C/60 Series C Compiler Package]

- ・ M3T-NC30WA C Compiler Guidebook (C Compiler Package for R8C/Tiny, M16C/60, M16C/30, M16C/20, M16C/10, M16C/Tiny Series)
- ・ M3T-NC30WA Assembler User's Manual (C Compiler Package for R8C/Tiny, M16C/60, M16C/30, M16C/20, M16C/10, M16C/Tiny Series)

Visit the following Renesas websites for information on this product:

Global site: http://www.renesas.com/pc7501

Japanese site: http://japan.renesas.com/pc7501

Renesas Website and Customer Support

Renesas Technology Website:
http://www.renesas.com/

Customer Support:
http://www.renesas.com/inquiry
csc@renesas.com

Revision History

Rev..	Publication Date	Revisions	
		Page	Description
1.00	Jul. 15, 2008	—	First edition

━━ **Notes regarding these materials** ━━

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